

PGIM QUANTITATIVE SOLUTIONS

BOARD LINKAGES: FINDING QUALITY IN BOARD QUANTITY

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Social networks have expanded the reach of our personal and professional relationships, leading us to develop connections and gain access to information that we otherwise may not have access to. We know the undeniable impact of social networks on individuals. But what's perhaps less obvious is the importance and impact of social networks on corporate success. As with individuals, social networks embedded in the corporate setting, most notably among boards of directors, facilitate the exchange of ideas and increase the flow of information among and between corporate boards. Our research demonstrates that using this nonfinancial data to augment our quality factor can lead to improved returns for asset owners.

Social network theory studies and explains the relationship between entities or nodes within a network. Companies form an intricate web of connections through various social and professional networks that can include owners, sell-side analyst, customers, and suppliers. In this study, we focus on company networks through their boards of directors. The interconnectedness that facilitates the exchange of ideas and the flow of information between corporate boards, known as interlocked directorate or board linkages, is well documented in academic literature. We leverage this existing social network analysis and incorporate graph theory to analyze the effects of broadening networks among corporate boards.

Companies in the Russell 3000 universe contain, on average, five to six board members, with a median connectedness of approximately three members on each board. Exhibit 1 demonstrates that over time, as the size of the average board increases, so does the median connectedness. Access to a broader network among board members facilitates the exchange of ideas and the flow of information. Highly connected corporate boards can potentially benefit from an expanded network by being able to secure better financing, accessing a deeper supply chain network, and witnessing and subsequently implementing best corporate governance practices.

Exhibit I: Information Flow: Board Size and Connectedness



Sources: S&P, FactSet, PGIM Quantitative Solutions. Data as of July 31, 2021.

Quantifying Board Centrality & Connectedness

We estimate the interconnectedness of companies by measuring their connections with other firms in their network. One of the factors that we use to measure the effectiveness of a company's board network is its degree of centrality. This first degree of connection between companies can be attributed to how many "links" their board members have formed.

Exhibit 2 illustrates an example of these linkages. Rows 1-4 represent board members and columns A, B, and C represent companies in the universe. Company A is connected to company B via Board Member '2' and has no connections to Company C. Company B is connected to company C through Board Member '1'. Therefore, because Company B has the most connections it is more central to the network.

Exhibit 2

	А	В	С
1	0		
2			0
3	0	0	1
4	1	0	0

Source: PGIM Quantitative Solutions

Disentangling the Information in Connections

As mentioned earlier, we found that companies with larger boards have higher connectedness to other companies' boards. Similarly, we found that board size is correlated with company size. We believe that as companies become more valuable in terms of market capitalization, they are able to attract more coveted board members, similar to how larger companies (in market capitalization), also have larger employee bases. Exhibit 3 depicts this relationship. When using board centrality measures, care needs to be taken in order to focus on the real information in the signal.

Exhibit 3: Larger Companies Have Higher Degree of Board Connectedness



Sources: S&P, FactSet, Compustat, PGIM Quantitative Solutions. Data as of July 31, 2021.

Factor Efficacy – Does it matter?

We applied our standard alpha testing framework to analyze the performance of the board connections factor adjusted for size in Russell benchmarks (Exhibit 4). While the factor shows efficacy in both the Russell 1000 and Russell 2000 universes, Exhibit 5 demonstrates that it is most effective among small-cap stocks, with an average monthly Information Coefficient¹ (IC) of 1.04%. Among large-cap stocks, the factor has an average monthly IC of 0.6%. The spread returns (Q1-Q5 in Exhibit 4) show similar efficacy in large and small caps. Later in this paper, we demonstrate that high board connectedness matters most in companies that are potentially in distress. We found that firms with the highest connectedness have the most significant improvement in profitability (ROA) and sales growth prospects. Thus, a strong factor efficacy in Russell 2000 compared to Russell 1000 is expected as companies in the small-cap space are more prone to having financial and stability issues. The factor also shows a strong positive in nine out of 11 sectors, with Financials, Materials, and Utilities showing the highest efficacy (Exhibit 6).

Exhibit 4: Performance Summary of Russell 1000 and Russell 2000 Indexes

	Russell 1000	Russell 2000
Annualized Active Return (Q1-Q5)%	2.42	6.50
Annualized Standard Deviation (%)	7.16	11.03
Sharpe Ratio	0.34	0.59

Sources: S&P, FactSet, Compustat, PGIM Quantitative Solutions. Data as of July 31, 2021.

¹ The information coefficient (IC) is a measure used to evaluate the skill of an investment analyst or an active portfolio manager by showing how closely the financial forecasts match actual financial results.

Exhibit 5: Monthly Information Coefficient of Russell 1000 and Russell 2000 Universes



Sources: S&P, FactSet, Compustat, PGIM Quantitative Solutions. Data as of July 31, 2021.



Russell 2000

Sources: S&P, FactSet, Compustat, PGIM Quantitative Solutions. Data as of July 31, 2021.

Exhibit 6: Monthly Information Coefficient of Russell 3000 Sectors



Sources: S&P, FactSet, Compustat, PGIM Quantitative Solutions. Data as of July 31, 2021.

How Board Connectedness Impacts Company Performance

Given that board connectedness is positively associated with future stock returns, it is worthwhile to further understand how connectedness translates to better stock returns. To do so, we carefully employed a quantitative investment process to shed more light on this issue. Each year starting in June, we formed three portfolios of companies: companies with the highest interconnectedness (top tercile), firms with the lowest interconnectedness (bottom tercile), and those in between. We examined the characteristics of these companies three years before and three years after portfolio formation. We found that the profitability of companies with the highest degree of board connections improved the most over the three-year period following portfolio formation as compared to companies with medium or low board connections.

It stands to reason that board interconnectedness is likely to be less effective in firms that are already generating strong profits. Therefore, companies with the highest board connections are the ones that show the greatest improvement in ROA. Results depicting the companies' ROA can be seen in Exhibit 7.

Exhibit 7: Return on Assets²



Sources: S&P, FactSet, Compustat, PGIM Quantitative Solutions. Data as of July 31, 2021.

² ROA is defined as Net Income/Average of Assets four quarters ago and most recent.

Exhibit 8 demonstrates the sales growth of high-, medium-, and low-centrality companies. It is evident that companies with the highest board connections also have the lowest sales growth. It is apparent that all companies experience a decline in sales growth prospects (defined as FY2 Sales Estimates/FY1 Sales Estimates) following portfolio formation. However, despite the overall sales growth weakness, the declines of high-centrality firms are much smaller than those of low-centrality firms. For companies with mature business models and stable operating processes, improving profitability measures might not yield swift revisions, as analysts may remain bearish and be reluctant to revise their forecasts for slower-growth firms. Greater analyst pessimism about the growth outlook for these stable companies means more opportunity for them to surprise on the upside. This leads to relatively flatter change in sales growth for firms with highly connected boards. In contrast, companies with lower board connectedness are typically "growthier," and generate greater analyst excitement. Subsequently, when profits disappoint, analysts revise sales growth estimates more quickly.

Exhibit 8: Sales Growth



Sources: S&P, FactSet, Compustat, PGIM Quantitative Solutions. Data as of July 31, 2021.

Looking at Exhibit 9, it is evident that the stock price performance of companies with the highest board centrality improves drastically in the three years following formation of the portfolios. In contrast, the stock price performance of low- and medium-centrality firms generally deteriorates during that period.

Exhibit 9: Historical Returns³



Sources: S&P, FactSet, Compustat, PGIM Quantitative Solutions. Data as of July 31, 2021.

³ Cumulative 12-month return.

Exhibits 7, 8, and 9 validate the point that high board interconnectedness matters the most in companies with relatively low financial prospects, and show two broad yet seemingly conflicting characteristics of companies with the highest board centrality. On the one hand, highly connected companies demonstrate stable yet low profitability and low growth prospects. On the other hand, these companies also show improved financial and stock price performance and slight improvement in growth prospects following portfolio formation. We believe that these contrasting characteristics of companies in the highest board centrality bucket are the result of two types of confounding effects:

- 1. The companies with the highest board connections are generally mature firms with established operations and overall low but stable profitability. From the perspective of board members, it is lucrative to be on the board of directors of such companies. There are few, if any, going concern doubts.
- 2. Another representative group in the highest board connections bucket is the group of firms that face headwinds and are taking corrective measures to improve the overall health of the company. Among other things, addressing these challenges would involve taking major steps in restructuring the company board, senior management, etc.

We believe that companies that fall into the second classification stand to benefit the most from higher board centrality due to their high cost of information acquisition. These low-performing firms with highly connected boards, or those that restructure their boards to have high connections, are more likely to experience a substantial benefit, such as a reduction in challenges securing new funds and establishing more favorable supplier relationships. By exerting their influence, connected directors are able to tap into their networks to facilitate lower costs and in turn, higher profitability. Additionally, companies with higher connectedness have been found to have better governance practices (see references). Given that boards provide oversight on management activities, firms with more connected boards should naturally benefit by employing the best corporate governance practices, exerting influence, and leading in setting the strategic vision of firms. One would expect this to be most beneficial for firms attempting major restructuring. Overall, higher board linkages imply that there are greater opportunities for board members to initiate reforms that can improve company profitability.

ESG Considerations

It's also likely that companies with higher interconnectedness have better governance practices. Some studies show (see references) that companies with the highest interconnectedness also score highly on ESG metrics. Given that boards provide oversight on management activities, firms with more connected boards should naturally benefit by employing the best corporate governance practices, exerting influence, and leading in setting the strategic vision of firms. Overall, this should result in better corporate governance oversight and better stakeholder management.

Conclusion

A company's board of directors acts on behalf of various stakeholders and is responsible for developing and enforcing corporate governance protocols. While a board's role can often be viewed as passive, a highly connected board is able to leverage its links to proactively implement best corporate governance practices and benefit from the rich flow of information contained in its network. We believe that by incorporating this level and extent of network linkages into the quality factor of their investment process, systematic quant managers can improve portfolio returns for asset owners.

References:

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